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**CALANOID COPEPODS COLLECTED FROM THE NEAR-BOTTOM  
IN TANABE BAY ON THE PACIFIC COAST OF THE  
MIDDLE HONSHU, JAPAN. I. ARIETELLIDAE<sup>1)</sup>**

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*With Text-figures 1-3 and Table 1*

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Although calanoid copepods are generally pelagic, a considerable number of species have hitherto been reported to live on or near sea-bottoms at a variety of depths. They are called "near-bottom" (Grice and Hulsemann, 1970), "bottom-form" (Sars, 1903), "bottom-living" (Bowmann and Gonzalez, 1961, Matthews, 1964, Fosshagen, 1968, Grice, 1972), "hyperbenthonic" (Bradford, 1969) or "planktobenthic" (Grice, 1972) calanoids, and are supposed to play an important ecological role in a transitional zone between the pelagic division and the benthic division. For example, Matthews (1964) stated that the main role of bottom-living species of Aetideidae and Phaennidae appeared to be that of scavenger and that their periods of greatest abundance coincided with periods of decline of plankton abundance in the upper layers. In Japan, however, very little attention has so far been paid upon these near-bottom calanoids. Tanaka's work (Tanaka, 1966) on some species of the families Arietellidae, Pseudocyclopidae and Stephidae found in straining sea-water leading from the coastal water to the aquarium at the Fishery Research Laboratory, Kyushu, has been a sole report of these calanoids.

With such circumstances in mind, the author has recently carried out intensive samplings of near-bottom calanoids in Tanabe Bay (33°42'N, 135°20'E), off the Seto Marine Biological Laboratory, on the Pacific coast of the middle Honshu, with a newly designed sledge-type net. As the first report from this work, the present paper describes a new species of the genus *Metacalanus* Cleve (Family Arietellidae).

Samplings for the present study were made at a definite area in the near-shore shallow water over the flat sandy bottom along the north beach of the Seto Marine Biological Laboratory. A newly designed sledge-type net with the mouth of 380 cm<sup>2</sup> and mesh size of 94  $\mu$ m (NXX 13 of the Japanese standard) was employed to sample the layer of 3-14 cm above the sea-bottom. The net is equipped with a closing apparatus worked by a messenger. Immediately before the net was pulled up to a boat, a messenger was dropped and the mouth of the net was completely closed. Accordingly, there is no contamination from the upper layers. The net was horizontally towed along the sea-bottom from a small boat. The samples were fixed in formalin immediately after capture. The specimens dissected were mounted onto slide glasses with Gum-chloral medium. The specimens were deposited in the Seto Marine Biological Laboratory, Kyoto University.

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1) Contribution from the Seto Marine Biological Laboratory, No. 705.

Before going further, I would like to express my sincere gratitude to Dr. T. Itô, Kyoto University, for his encouragements and reading the manuscript.

*Metacalanus acutioperculum* n. sp.

**Materials:** An adult female dissected was designated as the holotype. An adult female and two adult males dissected, and two intact specimens, an adult female and an adult male, were designated as paratypes. One of the two males dissected was designated as the allotype. Type-locality: Tanabe Bay, off the Seto Marine Biological Laboratory, on the Pacific coast of the middle Honshu, Japan. The specimens were collected with a sledge-type net (5 to 6 m in depth, 26-VI-1983).

**Female** (holotype). Body (Fig. 1-1 and 2) 0.73 mm long, colored reddish-brown on proximal segments of left antennule, tip of cephalosome, and urosome. Prosome, viewed dorsally, oval, about twice as long as its greatest width that occurs on first metasome segment. Cephalosome separated from first metasome segment and constricted a little posterior to the middle. Rostrum (Fig. 1-3) strongly developed, produced downwards, with a pair of long filaments distally and two minute hairs proximally. Fourth metasome segment completely fused with fifth metasome segment, of which posterior angles are symmetrical and rounded. Surface of prosome bearing branching and non-branching hairs. Urosome (see Fig. 1-4: paratype). As the genital segment of the holotype was broken in being dissected, the urosome of a paratyptic female dissected was figured. The description of urosome except

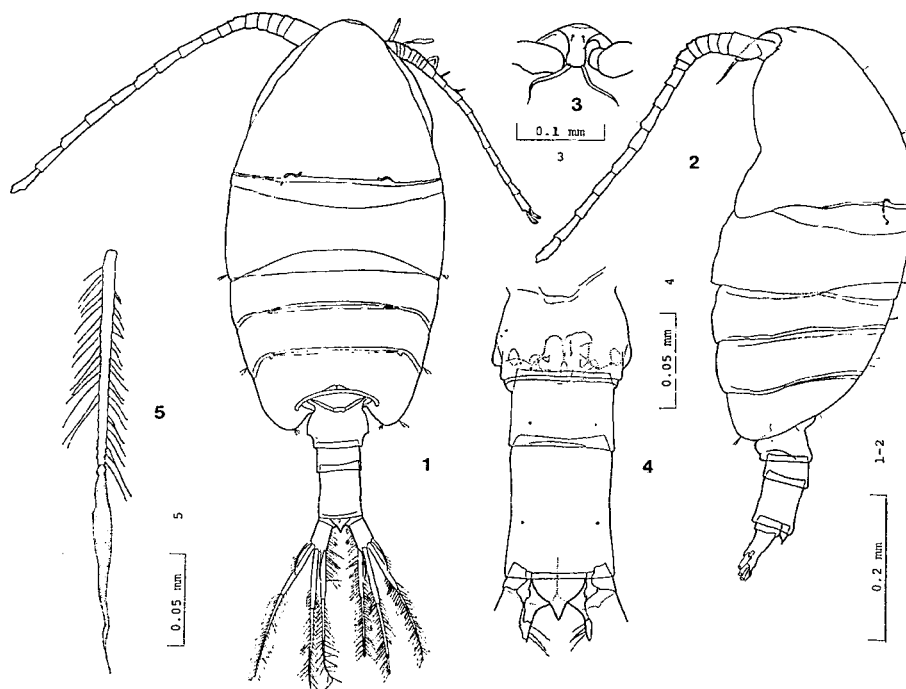


Fig. 1. *Metacalanus acutioperculum* n. sp. Female. (1-3, holotype; 4-5, paratype) 1. habitus, dorsal view; 2. habitus, lateral view; 3. rostrum; 4. urosome, dorsal view.

genital segment is based upon the holotype. Urosome composed of four segments, genital segments tumefied ventrolaterally, third segment longest; last segment shortest with a well-developed anal operculum, of which an apical third markedly tapers to a point. Caudal rami symmetrical, about 1.6 times as long as wide, each ramus furnished with fine hairs on inner margin, and two apical setae and an outer subapical seta which are plumose, long and jointed; a dorsal setula between two apical setae; a short hairy seta arising from outer margin near its apical end. Right antennule (Fig. 2-2) consisting of 18 segments, carrying long and thick aesthetascs on anterior margin along total length except a few segments. The first segment having

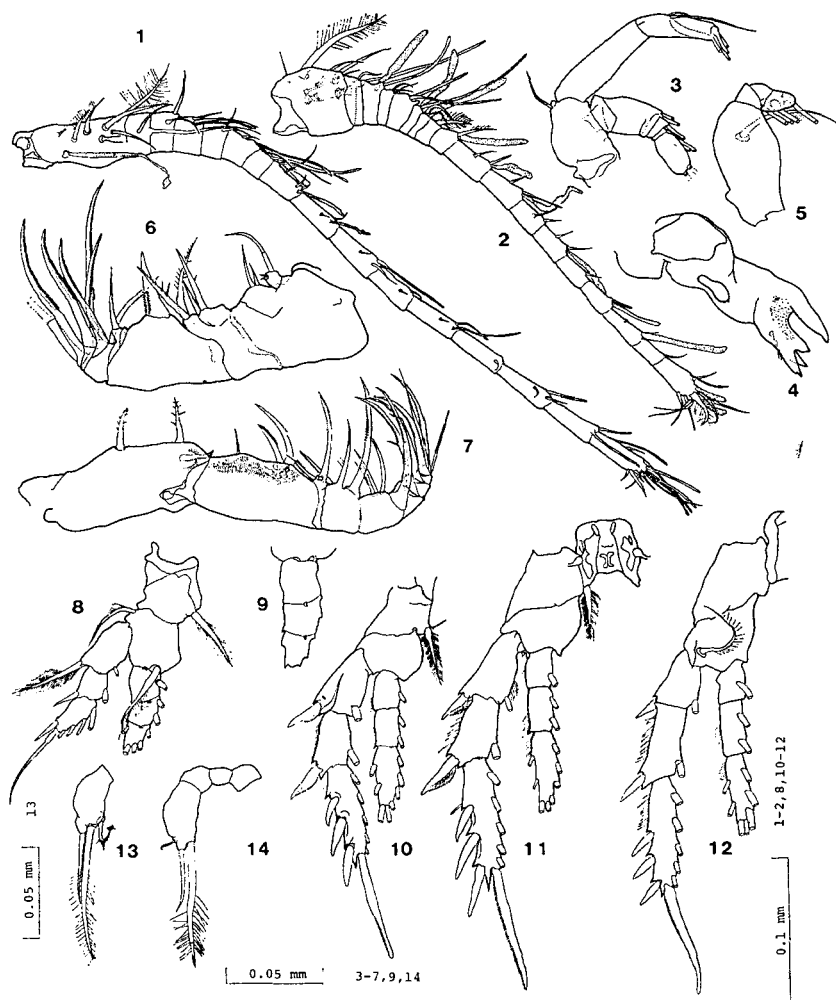


Fig. 2. *Metacalanus acutioperculum* n. sp. Female. (1-2, 4-14, holotype; 3, paratype) 1. left antennule; 2. right antennule; 3. antenna; 4. mandibular palpus; 5. mandibular gnathal lobe; 6. maxilla; 7. maxilliped; 8. leg 1, anterior face; 9. endopodite of leg 1, all setae omitted; 10. leg 2, anterior face; 11. leg 3, anterior face; 12. leg 4, posterior face; 13. right terminal segment of leg 5, anterior face; 14. left terminal segment and basal ones of leg 5, posterior face.

a very large plumose seta proximally. *Left antennule* (Fig. 2-1) consisting of 16 segments, slenderer and much longer than the right; proximal two segments partly fused with each other. *Aesthetascs* on the left antennule slenderer than on the right one. Terminal segment bearing jointed aesthetascs. *Antenna* (see Fig. 2-3; paratype). The preparation of the holotype is not good. The description of exopodite was founded on a paratypic female dissected. *Antenna* with basipodite bearing a small seta on the distal inner face. *Endopodite* slender, 2-segmented; first segment bearing no seta; second segment with four setae apically and two setae of unequal lengths laterally. *Exopodite* consists of five segments; no seta on segment 1, 2 distal setae on segment 2, 1 seta on segment 3, and 1 seta on segment 4; last segment carrying two apical setae and one lateral seta. *Mandible* with heavily chitinized gnathal lobe (Fig. 2-4) which is armed with four teeth and four minute spinules at the base of the first tooth. *Basipodite* of palpus (Fig. 2-5) having an inner seta. *Endopodite* wanting. *Exopodite* 3-segmented, bearing 1 seta on segment 1, 1 seta on segment 2, and 2 lateral setae and 1 distal seta on segment 3. *Maxillula*. The preparations of females are not good. See the description of the allotype. *Maxilla* (Fig. 2-6) very stout, with basal segments having six inner lobes or endites; the first bearing a long seta and two minute ones, the second and third with two setae; the fourth carrying two spinulose setae, and the fifth dilated in the middle and having a comparatively short but considerably strong spine with minute spinules along ventral edge of its basal half; the last bearing a naked seta. *Endopodite* composed of three segments, the first bearing two serrated setae and a serrate strong spine, the second with two serrated spines, the third carrying two serrated spines. *Maxilliped* (Fig. 2-7) consisting of two very large basipodite segments and five endopodite segments. *Basipodite* 1 armed with two spinulose inner spines, one of which locates medially and the other locates subapically, and one serrate lateral spine which locates subapically and arises near a knobby process with a fringe of hairs. *Basipodite* 2 carrying a naked inner setula on a point at a proximal third, two serrated setae at a distal third, a serrate seta on its inner end, and covered with numerous hairs near its inner lobules. *Endopodite* armed with serrated spines as that of maxilla. First endopodite segment having a serrated seta distally and three setae on the middle of inner margin. Second, third, fourth and fifth segments having 1, 2, 1 and 2 serrated spines, respectively; besides two serrated spines the fifth segment bearing two setae.

*Legs* 1 to 4 (Fig. 2-8, 9, 10, 11 and 12). Each leg having 2-segmented basipodite, 3-segmented endopodite and 3-segmented exopodite. Plumose setae present at the distal inner angles of basipodite 1 of legs 1 to 3. Each basipodite 2 of legs 1 to 4 not pointed at its inner end. Leg 1 is different from the following three legs: outer spines of second and third exopodite segments neither broad nor serrate, basipodite 2 with a seta near the base of endopodite segment and one on the outer margin, and first exopodite segment having not a spine but a large plumose seta at the distal outer angle. Second endopodite segment slightly prominent at outer distal angle. Leg 2 and 3 similar to each other except a few differences: the former smaller than the

Table 1. Seta and spine formula of legs 1 to 4. Setae are represented by Arabic and spines by Roman numerals. Si=inner boarder of segments; St=terminal boarder of segments; Se=outer boarder of segments.

	basipodite				endopodite						exopodite							
segment	1		2		1		2		3		1		2		3			
	Si	Se	Si	Se	Si	Se	Si	Se	Si	St	Se	Si	Se	Si	Se	Si	St	Se
leg 1	1	0	1	1	1	0	2	0	3	1	1	1	1	1	I	4	1	I
leg 2	1	0	0	0	1	0	2	0	4	2	2	1	I	1	I	5	I	III
leg 3	1	0	0	0	1	0	2	0	4	2	2	1	I	1	I	5	I	III
leg 4	0	0	0	1	1	0	2	0	3	2	2	1	I	1	I	5	I	III

latter, with first exopodite segment having a longitudinal ridge on the anterior face. Leg 4 carrying a plumose seta on the posterior face of basipodite 2 near the base of exopodite. The seta and spine formula is shown in Table 1.

*Leg 5* (Fig. 2-13 and 14) slightly symmetrical, uniramous and 2-segmented. Both of terminal segments lamelliform, and having a naked seta on the tip and a plumose seta on the distal inner end; the right bearing a plumose seta on the posterior face, the left with a short seta at the distal outer angle.

*Male* (allotype). Body (Fig. 3-1) 0.63 mm long, resembling the female in shape, but considerably slenderer. Prosoma similar to that of female. Urosome (see Fig. 3-2; paratype). The preparation of the allotype is not good. Therefore, the urosome of a paratypic male dissected was drawn. Urosome is composed of five segments, narrower than in female; anal operculum as in female. Appendages resembling those of female except for antennules and leg 5. Both antennules thicker than in female and provided with long and thick aesthetascs along the anterior margin. *Left antennule* (Fig. 3-3) consisting of 16 segments; there are two free segments distal to the articulation. *Right antennule* composed of 18 segments, shorter than the left. The difference of lengths of both antennules is not so distinct as in female.

*Leg 5* (see Fig. 3-5; paratype). The preparation of a paratypic male dissected is somewhat better. The description, however, is founded on the allotype. Leg 5 is slightly asymmetrical, uniramous, consisting of five segments. On the posterior face of right second segment is there a thick seta which arises from a large circular pore. Left second segment having a minute seta near the distal end on the posterior face. Each of third and fourth segments armed with one outer seta; setae of the right leg are longer and thicker than the counterparts of the left. Each terminal segment having a large and thick seta curved inside. *Maxillula* (Fig. 3-4) with first inner lobe or gnathobase poorly developed and without spines as most of other calanoids have, second with neither spine nor seta. First outer lobe carrying five setae. Endopodite represented by a small semi-globular protuberance on basipodite 2. Exopodite furnished with three plumose setae.

*Variation.* Comparison with all dissected types comes to conclusion that the

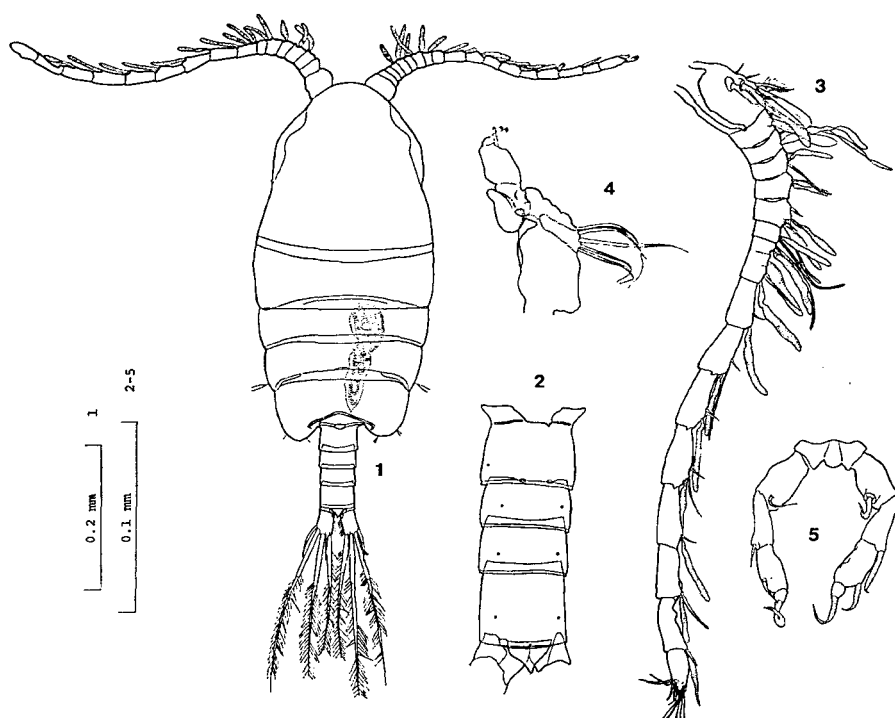


Fig. 3. *Metacalanus acutioperculum* n. sp. Male. (1, 3-4, allotype; 2, 5, paratype) 1. habitus, dorsal view; 2. urosome, dorsal view; 3. left antennule; 4. maxillula; 5. leg 5, posterior face.

asymmetrical structures of legs 5 of both sexes are not deformed. A paratypic female dissected has an unusual innermost caudal seta (Fig. 1-5), which is naked and broadened behind the middle, tapering distally.

*Remarks.* The original description of *Metacalanus aurivilli* Cleve, 1901 (Cleve, 1901), the only species of the genus, is too incorrect to be compared with the present species. Consequently, the author depended mainly upon the description of *M. aurivilli* by Chen and Zhang (1965) in comparison with the present species.

The present species differs from *M. aurivilli* in 1) the smaller numbers of antennular segments, 2) the presence of the apically pointed anal operculum, and 3) the more asymmetrical structures of legs 5 of both sexes: the differences of the position of the most minute setae on the terminal segments in female and of the characteristics of the distal setae of the third and fourth segments in male. In comparison between the figures of *M. aurivilli* from Ceylon by Thompson and Scott (1903) and from the East China Sea by Chen and Zhang (1965), there are a few differences: the presence of setae on the second segments of leg 5 in male and the characteristics of setae on terminal segments of leg 5 in female. It is probable that Thompson and Scott overlooked the presence of setae on the second segments of leg 5 in male. In addition, a minute dorsal setula on the caudal ramus is not found in the figures of *M. aurivilli* reported by Thompson and Scott and Chen and Zhang, although the

present new species has it. It might be overlooked by the previous authors.

Anraku and Omori (1963) stated that, in carnivorous calanoid copepods, the mouth-parts have few setae, being, on the whole, simpler, that maxillula, maxilla and maxilliped are modified as prehensile appendages, and that the cutting edges of the mandibles have very sharp teeth. In consideration of these facts, the present species seems to be carnivorous, although its maxillula is considerably rudimentary.

The specific name "*acutioperculum*" derives from the well-developed anal operculum with the apically pointed tip.

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